HYDROLOGY K10/D3 11 PLANS 1 of 2

K10/D3

11 Plans

City of Albuquerque, New Mexico
Engineering Division

Memorandum - May 1, 1980

K 10-03

TO: Gene Mares, Principal Planner

FROM: Richard S. Heller, City Engineer

SUBJECT: Atrisco Business Park Master Plan

The drainage concepts presented by the master plan, are not acceptable to the City Engineer's Office. Specifically:

1. All offsite flows entering the study area both from the north and the west must be collected with appropriate drainage facilities and must be treated in a manner approved by the City Engineer. The off-site detention area, to the west of the development, is presently outside the City's jurisdiction. The storage capability of that facility must be consistent with the ultimate development of the watersheds intercepted (the appropriate inflow outflow hydrographs must be supplied and found satisfactory by the office of the City Engineer.) At this time the City cannot accept the responsibility for the maintenance of the detention area. Therefore, legal means must be devised to insure the permanence of the detention area and to guarantee to the City its maintenance by the developer until all the flows north of the Freeway are intercepted as recommended by Dr. Heggen's report.. The approach of the master plan which anticipates that the excess runoff of the more infrequent storms, will continue to the east and south along preexisting flow paths, is not acceptable in an urbanizing area. The concern expressed here is that the overflow of the detention facility could affect the light industrial area shown on the master plan.

2. The drainage concept for the individual parcels within the development, which envisions onsite ponding with no maintenance nor liability responsibility for the City, is acceptable provided that all such detention ponds have positive outlets. While we recognize that playas with no natural outlets occupy a significant portion of the master planned area, the intended development will obliterate said natural storage ponds. Therefore, an equivalent volume must be supplied, but an outlet must also be provided for the safe disposal of the excess runoff.

3. Storm runoff from public streets may not be discharged onto private ponding area; the streets must be regraded to convey the runoff to the eastern side of the tract and thence

north to the northeast corner, where the City will eventually construct an outfall to the Rio Grande River. The committment by the City to provide an outfall for this area has been discussed with representatives of the Westland Development Corporation. This design approach was previously indicated to the developer's Engineer, and is in accordance with the result of the study performed by Dr. Heggen, which has been made available to the consultant. This approach is also consistent with previously adopted West Mesa Drainage Concepts.

Therefore, the City will design the outfall facility, to collect the runoff from the Atrisco Business Park, including the street runoff, the storm runoff discharged in a controller manner from the private detention areas and the runoff entering the Atrisco Business Park from the north and west.

Since the construction of the facilities is contingent upon voters approval, the drainage plan must suggest interim solutions that will suffice until the necessary funds become available to the City. A review of the capability of existing facilities east of Coors Blvd., indicates that Bluewater outfall storm sewer is not available for any service to this area, and this condition must be recognized in the provision of the interim solution as well.

Regarding the street pattern, we would like to suggest a more direct east-west orientation of Los Volcanes Road, and the intersection into those major roads without curvilinear alignment (as shown on the plans for each road midway in the development.)

FRED DENNEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
2400 COMANCHE ROAD, N.E.
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-8852

April 2, 1980

F10-03

RECEIVED
APR 03 1980
CITY ENGINEER

Mr. Richard Heller
City Engineer
City of Albuquerque
P.O. Box 1293
Albuquerque, New Mexico 87103

Re: Atrisco Business Park
Drainage Plan
F.D. Job No. 451.12

Dear Mr. Heller:

Transmitted herewith are three copies of the revised Drainage Plan for Atrisco Business Park. This plan reflects the proposed modifications to the development plan, and more importantly current conditions insofar as upstream drainage control.

You will note that the plan provides for managing 100% of all runoff in ponds with no flows in the 100-year storm event leaving the site. By covenant the owners will require on-site ponding for each individual site development and will provide ponding for street drainage as indicated. A very small bleeder system which will evacuate the ponds over a long period of time has been provided.

It should be emphasized that Westland is still considering a more extensive storm drainage system which would connect to a possible future City system to the North. However, it has been decided that a workable system must be designed now in order for some imminent development to proceed. It seems apparent that since 100% of the 100-year storm is being managed the plan meets all current requirements.

The Environmental Planning Commission will consider the revised development plan on April 24, 1980. That plan

RSH ADM
HRO SUR
CDS COUN
DES SEC
INSP FILE
HYDRO RETURN

Review & Comment note 4/24/80 date above

shows this proposed drainage management in general terms for use of the planning staff and commission. This more detailed submission is for you and your staff. I am sure that EPC will want your comments at the time of the hearing.

We will be pleased to discuss this plan with you at your convenience.

Very truly yours,

Fred Denney

FD/lm

Enclosures

cc: Westland Development Co.

CITY OF ALBUQUERQUE

ALBUQUERQUE, NEW MEXICO

INTER-OFFICE CORRESPONDENCE February 27, 1980 REF. NO._____

F10-03

TO: Richard Heller, City Engineer

FROM: Bruno Conegliano, Assistant City Engineer/Hydrology B.C

SUBJECT: Land Transaction with Mr. Robert Pinkard and Westland Corporation (Zoning Annexation Request AX-807)

I just had a conversation with Mr. Fred Deney, and he has advised me that the Westland Corporation is upgrading the land use plan for the Atrisco Business Park. Given the quality of customers seeked, a pipe yard site would not be acceptable; as a consequence the probability of obtaining Westland concurrence to such a transaction are between slim and nil. It is apparent the City will have to find the funds to purchase this 5 acre parcel.

BC/lc

Rip-
Bruno will be gone next month & this project (zone change & annexation) was granted a one month extension. It is obvious that we will have to get the [illegible] to buy the land. Do you h[illegible] any spare change or a plan of attack?
RSH
2/27

RSH RSH ADM ____
HRO ____ SUR ____
CUS ____ COUN ____
DES ____ SEC ____
INSP ____ FILE ____
HYDRO ____ RETURN ____

CITY OF ALBUQUERQUE

ALBUQUERQUE, NEW MEXICO

INTER-OFFICE CORRESPONDENCE February 5, 1980 REF. NO. W10

TO: Distribution Below

FROM: Richard Heller, City Engineer

SUBJECT: West Mesa Drainage Plan by Richard Heggen, December, 1979

Attached is a copy of subject plan for your information, review and files.

HRO/RSH/fs
Enclosure
cc - Gerald Davenport
Larry Frishman
Dwayne Sheppard
Bruno Conegliano
Richard Leonard
Fred Denney, Fred Denney & Assoc.
Joe Pino, Gordon Herkenhoff & Assoc.

WEST MESA DRAINAGE PLAN ----------
ATRISCO BUSINESS PARK AREA

Richard Heggen
December, 1979

WEST MESA DRAINAGE PLAN
ATRISCO BUSINESS PARK AREA

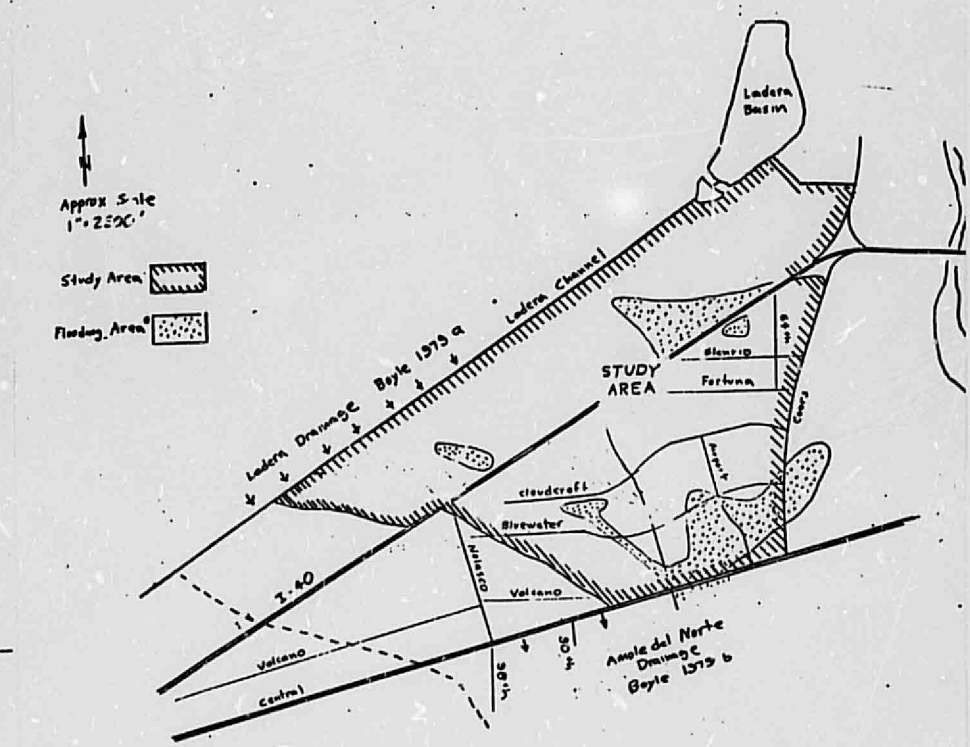
Richard J. Heggen
December, 1979

STUDY AREA

The study area is shown in Fig. 1. The area is bordered on the east by Coors, on the north by the Ladera channel (Boyle, 1979a*) and on the south by the Amole del Norte drainage (Boyle, 1979b). Also shown are approximate flooding areas identified in Corps, 1976.

Fig 2, Drainage Plan, shows the study area as subareas 2,3,4,5,6,12,14,17, and 18, and portions of 11,15, and 16. Table 1 references subareas in this report to previous reports in which each has been investigated.

* - References in Appendix A, Table 2



* Approximate areas only. See Corps, 1976. Does not reflect Ladera channel

Figure 1
STUDY AREA
Revised 11/30/79

Notes:

1. Culverts on I-40 and Central taken from Molotsky, 1974 and Hershkoloff, 1973. Any design using these structures requires field verification of size and location as these two reports differ in culvert inventories
2. Arroyos indicated are from Bovey, 1978. Any design using existing arroyos (City, 1975) requires field verification of location
3. Drainage areas from Bovey, 1978 and Boyle, 1979a and 1979b. Further design requires that the 13-14 boundary be fixed according to final plans for Aguaje del Norte

Scale 1" = 725'
traced from Exhibit 1, Bovey, 1978

Figure 2.
DRAINAGE PLAN
Revised 11/30/79

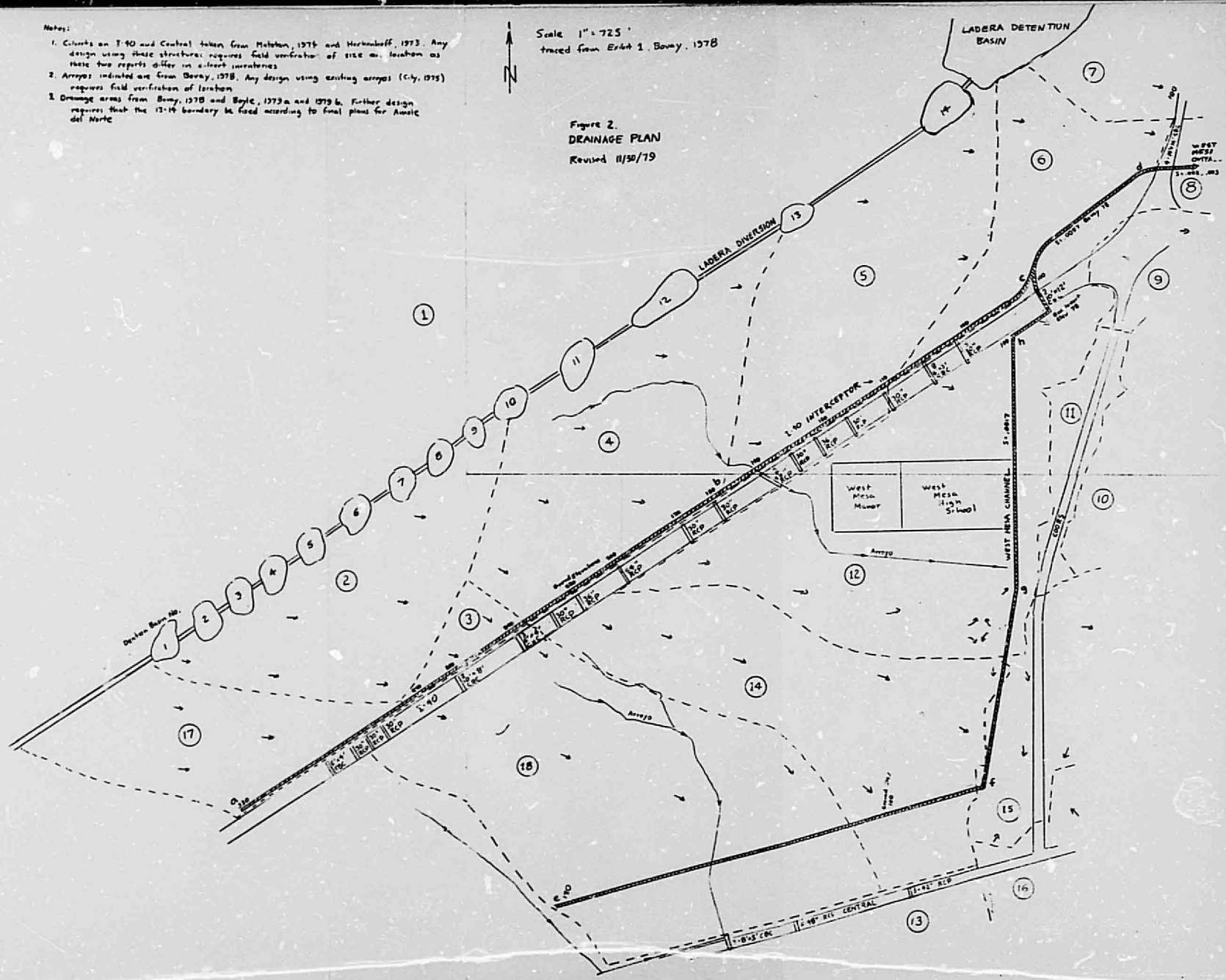


TABLE 1. NOTES ON DRAINAGE AREAS SHOWN IN FIG. 2.

Area	Name	Area (Acres)	Notes	Reference
1	Ladera Interception		From north. Currently intercepted as shown	Boyle, 1979a
2		236	Proposed to be diverted by developers to Ladera. Here proposed to be intercepted by I-40 Interceptor	Boyle, 1979a
3		30	Proposed to flow under I-40 to Amole del Norte. Here proposed to be intercepted by I-40 Interceptor	Boyle, 1979b
4		317	Proposed to be diverted by developers to Ladera. Here proposed to be intercepted by I-40 Interceptor	Boyle, 1979a Matotan, 1975
5		297	Proposed to be developed by developers to Ladera. Here proposed to be intercepted by I-40 Interceptor	Boyle, 1979a Matotan, 1975
6		163	Proposed to be collected in channel CA-1 as part of West Mesa Diversion. This treatment here endorsed	Matotan, 1975 Bovay, 1978
7	N. Coors		Proposed to be collected along Coors and transmitted by storm sewer to West Mesa Outfall. This treatment here endorsed	Bovay, 1978
8			Proposed to be inlet into West Mesa Outfall. This treatment here endorsed	Bovay, 1978
9	Coors - I-40		Drainage ditch south of I-40 to river. No impact on proposed system	
10	Riverview		To Riverview outfall. Existing storm sewer. No impact on proposed system	Bovay, 1978
11	Coors	57	North to subarea 9. Existing storm sewer. West Mesa Channel here proposed might drain a portion of this area to west of Coors	Bovay, 1978
12	West Mesa Diversion	468	To West Mesa Channel, then north under I-40. This treatment here endorsed. "Local System" to I-40	Bovay, 1978 Matotan, 1975
13	Amole del Norte		Drainage to Amole del Norte. See notes 17 and 18.	Bovay, 1979b Matotan, 1975
14		396	Not included in current drainage plans (area includes 55 acres of I-40) "Area subject to shallow flooding under unpredictable flow paths"	Corps, 1976
15	Bluewater		To Bluewater outfall. Existing storm sewer. West Mesa Channel here proposed might drain a portion of this area to west of Coors	Bovay, 1978
16	Central		To Central outfall. Existing storm sewer. No impact on proposed system	Bovay, 1978
17		176	Subarea 11-E in Boyle proposed to drain to Amole del Norte. Here proposed to be intercepted by I-40 interceptor	Boyle, 1979b
18		533	Subareas 11-A3, 11-F1 and 11-F2 proposed to drain to Amole del Norte. Here proposed to be intercepted by West Mesa Channel	

THE PROBLEM

No comprehensive plan for flood protection is in effect for this entire study area. Rather, a series of plans have been presented for portions of the study area. Appendix A recapitulates portions of these plans. These plans together yield a piecemeal solution to drainage in the study area in which some runoff is diverted north to Ladera, some south to Amole del Norte, and some treated locally.

Alternatives of flood management in the study area have become more clearly defined by establishment of drainage structures to the north (Ladera, Boyle, 1979a) and south (Amole del Norte, Boyle, 1979b). This study addresses drainage management between these two areas.

The objectives of this study are twofold:

1) To propose a general plan of drainage for the study area, and

2) to suggest criteria for engineering studies to implement the plan.

Because flood spill from the study area will worsen flooding between the mesa and river, and that zone is inadequately protected presently (Bovay, 1978), design is for the 100 year event.

PROPOSED DRAINAGE PLAN

The plan proposed is similar in design to "Preliminary Design, Lines A,B, and C - West Mesa Diversion Channels", Herkenhoff, 1968. The plan proposed is in accord with the area's master plan, Matotan, 1975 City, 1975. This plan identifies a solution for the "Local System" called for in the master plan and proposes drainage area modifications in several cases where the "Local System" might control runoff more economically than extensions of neighboring drainage systems. The plan follows:

1) Bovay, 1978 lists drainage capacities for subareas 7,8,11,15, and 16 (Table 1 and Fig. 2, this report) and suggests improvements, typically inlet additions and sewer replacement. Appendix B outlines proposed implementation of Bovay, 1978 on a subarea-by-subarea basis as it relates to this study. None of these subareas should have drainage upgraded until a firm decision is made on the West Mesa channel (see Item 2), as runoff from upper portions of these subareas might be carried by that channel.

2) The West Mesa channel should be constructed as shown by e-f-g-h-c-d on Fig. 2. From d the channel will discharge to a river outfall (see Item 4). Adequate box culverts at c and d are in place. Drainage easement exists for portions of the route from g to the outfall. The alignment upstream from g might be modified for existing or anticipated development. The layout shown is approximately that of Herkenhoff, 1973. It is likely that the upper portion of this channel could be underground conduit. A discussion of hydraulic aspects of this channel is found in Appendix C.

3) The I-40 interceptor should be constructed as shown by a-b-c on Fig. 2. This channel might be constructed on or adjacent to highway right-of-way. All I-40 culverts between a and c will be closed. Subareas 17 and 3, currently included in the Amole del Norte system (Boyle, 1979b), and subareas 2,4, and 5, anticipated to drain to the Ladera system (Boyle, 1979a), will naturally drain into this interceptor.

The I-40 interceptor may be compared with two drainage alternatives. The first would be that of allowing natural drainage under I-40 to the West Mesa Channel. Discharge capacity of that channel is limited by slope. In addition, property between I-40 and the West Mesa channel would be subject to across-the-freeway runoff, in contrast to the master plan (Matotan, 1975, City, 1975). Thus, it is proper to divert flow above I-40

A second alternative is that of diverting flow north to the Ladera channel (Matotan, 1975). Ladera is designed for this inflow (Boyle, 1979a). It may be observed from Fig. 2 that the diversions suggested (between subareas 2 and 4, 4 and 5, and 5 and 6) are longer than the I-40 Interceptor. The three diversions cut property and would require road crossings. The three diversions would be of slight slope, requiring larger channel dimensions. The I-40 interceptor, on the other hand, has substantial slope and does not divide property. It might serve as a buffer between developed property and a no-access portion of the freeway. Hydraulic aspects of the I-40 interceptor are discussed in Appendix D.

4) A West Mesa outfall should be constructed to the Rio Grande. Herkenhoff, 1968 indicates that preliminary work may have been done on this design. Such study may be of reduced value today, however, as discharges in that report did not reflect the current Ladera channel. Appendix E deals with hydraulic aspects of this outfall.

COST

A preliminary estimate of project cost is $4 to $7 million.

This estimate may be compared to Matotan, 75's estimation of the I-40 diversion channel (i to outfall, Fig. 2, this report) alone. This cost was given as $.782 million (1974). It did not include the West Mesa channel below I-40 nor did it include the I-40 interceptor.

Bovay, 1978 estimated the g to outfall system to cost $2.7 million.

CRITERIA FOR ENGINEERING DESIGN

The technical data in Appendices C - E represents initial calculations only. Engineering study should include the following items:

1) Precipitation data from Matotan, 1974. There is no reason to use Herkenhoff 1963 PDIF curves (Bovay, 1978). That data is old (1962) and for the wrong area (the East Mesa).

2) Infiltration rates for a fully urbanized area without onsite retention. An initial abstraction of 0.2 inches for depression storage and a 0.5 inch-per-hour infiltration rate for one hour is suggested, for pervious areas. Matotan, 1974, Appendix provides useful estimates for these abstractions.

3) Unit hydrograph development by the Colorado Urban Hydrograph Procedure (Design Criteria Manual, Denver COG, 1975). If an SCS procedure is used, the engineer should document that the method is calibrated for urban studies.

4) Hydraulic routing of channel flows. Rational formula-based design is entirely inadequate, as the peak flows from subareas within the basin will hit the West Mesa channel at significantly different times.

5) Economic analysis of pipe and channel alternatives. It appears that the upper reaches of the West Mesa channel might be drained by conduit, especially if drainage easement does not exist (see Appendix C).

Discharge from Coors to the outfall may be enclosed by box or circular culvert (see Appendix E). Drop structures might be used with an earth I-40 interceptor, or a smaller concrete channel could be employed (see Appendix D).

6) Design and construction should proceed in the following sequence:

I. Agreement should be reached between City and Developers concerning drainage plan for all subareas contributing to West Mesa Outfall flow. This would include preliminary design of the West Mesa Channel below I-40, of I-40 Interceptor to point "c" (if diversion to Ladera not employed), and any North Coors drainage to the outfall.

II. Given inflows to the drainage system, the Coors-to-river outfall should be designed.

III. The Coors-to-river portion should be constructed.

IV. The West Mesa channel and I-40 Interceptor should be constructed with respective upstream development.

APPENDIX A - BACKGROUND

A brief recapitulation of drainage planning for the study area follows.

Herkenhoff, 1963 identified drainage areas and defined the 100-year storm for Albuquerque. Herkenhoff, 1968 proposed two basic structures; the I-40 diversion on the freeway's north boundary and the West Mesa channel to the west of Coors. The Coors and I-40 box culverts were constructed for that flow.

This general Herkenhoff drainage scheme was taken as basis for subsequent development planning. Herkenhoff, 1972 and 1973 indicated preliminary layout of the West Mesa channel with a possible southerly extension to Central.

Matotan, 1974 improved upon basic drainage data. Among other large-scale management options, the following alternatives were considered: placement of the I-40 diversion along the freeway vs. along the powerlines to the north; construction of a direct discharge outfall to the river vs. the Mirehaven (Ladera) detention basin; construction of the West Mesa channel along Central and Coors vs. extension of the Tierra Bayita (Amole del Norte) channels northward to Central. In each case, the second alternative was selected by AMAFCA, recommended in Matotan, 1975, confirmed by the City and County, 1975, and has been or is being implemented. In effect, drainage between Coors and I-40, the focus of this review, was removed from the larger scheme and relegated to a "local" problem (Matotan, 1975).

Leverton-Denny, 1974 designed Atrisco Business Park drainage on the basis of Matotan, 1974's suggested adjacent-to-freeway I-40 channel. With this assumed upstream protection and the lack of public interest in any West Mesa channel, the drainage easement through the business park for that channel was foreseen to be not used.

Matotan, 1975 suggested some flood protection for the study area by diverting north-of-freeway flow back up to Mirehaven. Such diversion was classified as temporary.

Bohannan-Westman-Huston, 1975 with its attached correspondence, reveals the degree of uncertainty enveloping the drainage issue. AMAFCA had assured Bohannan that the I-40 interceptor would be built. The City did not consider such assurance to be adequate for permit purposes. Bohannan offered a temporary ponding solution that would suffice until the upstream protection was in place. It was agreed that the developer would be released from that ponding requirement and the City would assume responsibility in 1979. In 1977, in review of Bovay, 1978, the developer expressed concern that this new plan would jepordize his land by conduiting additional flow under I-40 in opposition to Matotan, 1974, the supposedly accepted master plan.

Boyle, 1978 outlined Tierra Bayita alternatives south of Central. Bovay, 1978 outlined a plan of sewer upgrading east of Coors and at West Mesa channel. Between these two plans lies an ill-defined drainage through the abandoned airport site that neither drains.

Boyle, 1979a allowed for northerly drainage from I-40 to Ladera, but this modification has not been implemented. Boyle, 1979b provided final description of the Amole drainage. It is the yet-unplanned drainage area between these two studies with which this report deals.

Table 2

REPORTS PERTINENT TO DRAINAGE PROBLEM

Master Plan of Drainage, City of Albuquerque	Herkenhoff	1963
West Side Diversion Channel Phase 1	Herkenhoff	1968
Engineers Report for Atrisco Business Park	Herkenhoff	1972
Atrisco Business Park Unit 1, Drainage Report	Herkenhoff	1972
Atrisco Business Park Unit 2, Drainage Report	Herkenhoff	1973
Western Albuquerque Metropolitan Area Drainage Management Plan Interim Report	Matotan	1974
Planning Report		1975
Atrisco Business Park Drainage Report	Leverton-Denney	1974
Guidelines for Public Systems, Area West of Rio Grande	City Council County Com.	1975
West Mesa Manor Subdivision	Bohannan-Westman-Huston	1975
Supplement No. 1 - Flood Plain Information Albuquerque Arroyos	Corps	1976
West Mesa Drainage Phase II	Boyle	1978
West Side Drainage Study 1977	Bovay	1978
Design Report for the Ladera Storm Drainage Diversion and Detention System	Boyle	1979a
Amole del Norte Diversion Facility, Preliminary	Boyle	1979b

APPENDIX B - BOVAY, 1978

It is not the purpose of this study to evaluate Bovay, 1978. The following proposal for implementation of that report does not reflect a technical review or cost-effectiveness analysis, but rather a general scheme of development coordinated with flood protection proposed for the study area in this report.

Bovay subarea 1 (downstream of 8, this report). With West Mesa outfall passing through this zone, some of the zone's runoff might be discharged into it. This may reduce some of the recommended sewer replacement for this zone.

Bovay subarea 3 (11, this report). The west-east gradient is so slight that it might be possible to divert flow from properties on west side of Coors back to West Mesa channel. This would have minimal impact on flow in the channel and might save replacing three-year-old pipe under Coors.

Bovay subarea 5 (15, this report). This system seems to be in need of substantial upgrading. Westward grading to the West Mesa channel from Coors might reduce the need to modify the Coors portion of this system.

Bovay subarea 6 (16, this report). This system also seems to be substantially inadequate. There is no modification of the West Mesa drainage that would aid this subarea. If the area 14, this report, is not adequately drained, Bovay subareas 5 and 6 may be in even worse trouble than foreseen in Bovay, 1978.

Bovay subarea 9 (7, this report). This area will drain south to the West Mesa outfall. The drop inlet to the West Mesa outfall should be constructed when that outfall is built. The storm sewer for this subarea should be constructed with development.

Bovay subarea 10 (6,8, and 12, this report). The West Mesa channel proposed by Bovay is inadequate for the additional drainage requirements (subareas 2,3,4,5,14,17,18, and small portions of 11 and 15) given in this report. The channel must be lengthened and enlarged.

Bovay subareas 2,4,7,8,11,12, and 13. These areas do not affect drainage in the study area of this report.

APPENDIX C - WEST MESA CHANNEL

Discharge at point h in this channel has been estimated as follows:

Bovay, 1978	Q100 = 547 cfs.	Does not include subareas 14 and 18
Matotan, 1975	Q25 = 438 cfs.	No West Mesa channel
Herkenhoff, 1972	Q capacity = 1885 cfs.	Includes runoff crossing I-40

Hydrographs for subzones within subareas 12,14, and 18 should be developed and routed down the West Mesa channel (see Criteria for Engineering Design). An initial estimate of Q100 is 1200 cfs.

The attached profile illustrates the minimal slope associated with this channel. Only by virtue of the low invert of the I-40 boxes can f ow be drained to the north.

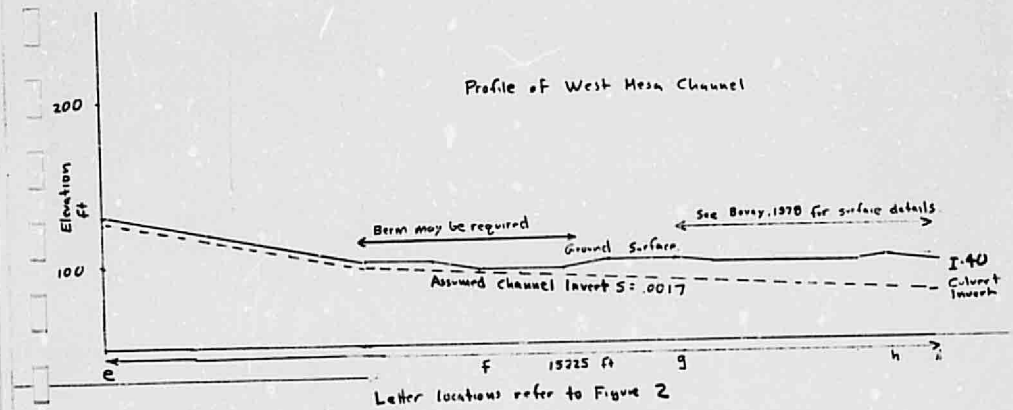
Alternatives exist for draining subareas by storm sewers running to the West Mesa channel. This may reduce land acquisition costs, but flat slope may necessitate large conduits.

Sample Design for West Mesa Channel

Point h Q = 1200 cfs., s = .0017

	Bottom Width (ft)	Side Slope	Flow Depth (ft)	V(fps)	F
Earth lined	24	3	5.22	5.79	.527
Concrete lined	10	2	5.66	9.93	.910

A concrete channel is recommended to reduce channel width and to control bed erosion. See Table 3 for additional alternatives of channel design. Care is needed to keep F sufficiently below 1.0. A roughened concrete surface may be required. Drop structues are unlikely to be warranted, as bed slope is already minimal. Both I-40 boxes should be used, spreading the flow and reducing velocity before confluence with the I-40 interceptor.


Profile of West Mesa Channel
200
Elevation ft
100
Berm may be required
See Bovey, 1978 for surface details
Ground Surface
I-40
Culvert Inverts
Assumed Channel Invert S = .0017
e
f
15225 ft
g
h
i
Letter locations refer to Figure 2

APPENDIX D - I-40 INTERCEPTOR

Discharge in this channel will be derived from the following subareas (Boyle, 1979a):

Subarea	Q_{100}
17	180
2	240
3	10
4	352
5	298
	1080 cfs.

In that the above discharges are determined for diversion to Ladera, and the I-40 route is somewhat shorter in total length, the values may be low. On the other hand, peak discharge from each subarea will not occur simultaneously at point c. The 1080 cfs value is sufficient for initial evaluation.

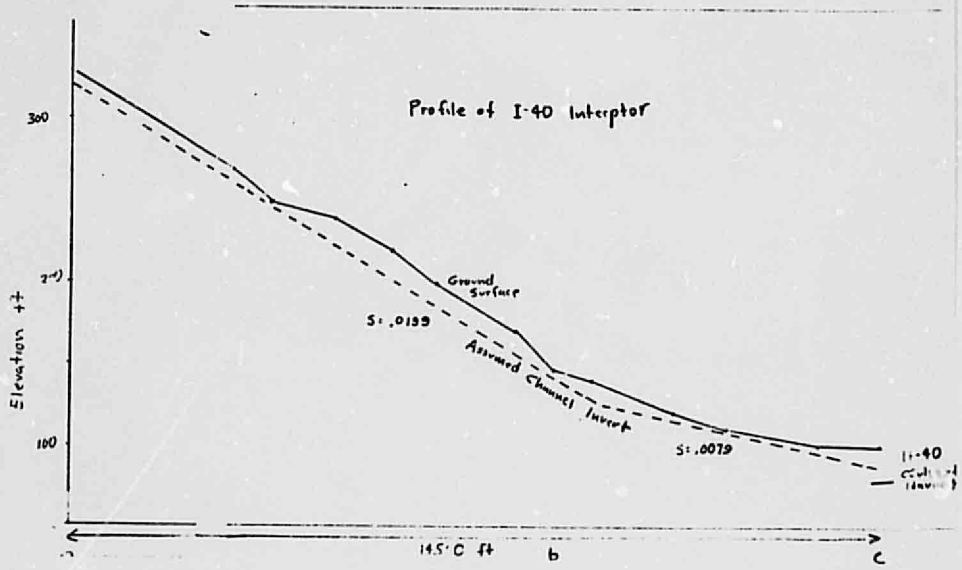
The attached profile illustrates channel slope. The example design following is based on the portion of the I-40 interceptor above point c.

Sample Design for I-40 Interceptor

Point c, Q = 1080 cfs, s = .0079

	Bottom Width	Side Slope	Flow Depth		
	(ft)		(ft)	V(fps)	F
Concrete lined	10	2	3.67	16.96	1.861

An earth channel alone will have excessive velocities and Froude too close to critical. See Table 3. Drop structures might be used to reduce slope, thus allowing earthen reaches. Design of the confluence of this flow with that of the West Mesa channel should be in accord with the Corps' Hydraulic Design of Flood Control Channels. Froude is high and should be kept high as flow continues from c to d and onward to the outfall.


Profile of I-40 Interceptor
300
200
100
Elevation ft
Ground Surface
S: .0139
Assumed Channel Invert
S: .0079
I-40
14.5·0 ft
b
c

APPENDIX E - WEST MESA OUTFALL

Discharge from point c to the outfall is estimated to be:

1200 cfs from West Mesa boxes on I-40
1080 cfs from I-40 interceptor
180 cfs from subarea 6 (Bovay, 1978)
820 cfs from subareas 7,8, and below 8 (Bovay, 1978)
3280 cfs total

These peaks will not occur simultaneously; until an adequate routing is done, peak Q is estimated to be 2200 cfs. This value may be compared to a Q_{25} of 489 cfs without the I-40 interceptor and local collection below I-40 in place of the West Mesa channel (Matotan, 1975). Q_{100} is generally 2.5 times Q_{25} in that report.

An open channel above Coors (points c to d) is tentatively sized for 1800 cfs as illustration. Alternatives for the channel from Coors to the outfall follow. An initial description of the required outfall is then given.

Sample design for outfall channel

Point d, Q=1500 cfs, s = .0057

	Bottom Width (ft)	Side Slope	Flow Depth (ft)	V(fps)	F
Concrete lined	20	0	4.43	16.93	1.417

The curved channel must discharge into the Coors 14 ft. culverts. The channel curvature and supercritical flow create design complications. The proposed plan brings the c-d portion away from the freeway to improve hydraulic behavior. The supercritical nature of flow requires wave analysis both at bend and transition. It is likely that substantial freeboard is needed, but it appears that the location of this portion of the channel imposes minimal constraints on channel dimensions. Vertical sidewalls are suggested for the curvalinear supercritical flow. Two of the box culverts are likely to be needed to prevent a hydraulic jump in the entrance transition.

Below Coors, Q = 2200 cfs, s = .003 - .008

	Bottom Width (ft)	Side Slope	Flow Depth (ft)	V(fps)	F
Concrete lined s = .008	12	0	8.38	21.87	1.331

To keep flow supercritical, an open channel must slope more than .004. See Table 3. Such a channel with 2:1 sides is not practical, given the high ground elevation shown on the profile. A pressure conduit might be used if dropped a roughly-estimated 20 ft. for inlet head. Bovay, 1978 provides an initial design for this conduit, though a 12ft. x 12ft. box culvert may be required in place of the 12ft. circular conduit suggested.

Outfall

Discharge must fall roughly 80ft. and then run another 700ft. from outfall toe to the river. Alternatives of outfall design include a double hydraulic jump (see CSU proposal, Herkenhoff, 1968) or a flip bucket toe. Scour depth must be checked both for flood discharge from the outfall and flood discharge in the river. Model study is generally called for in such outfall design, but in this case, conventional spillway design coupled with conservative toe foundation might yield satisfactory results.

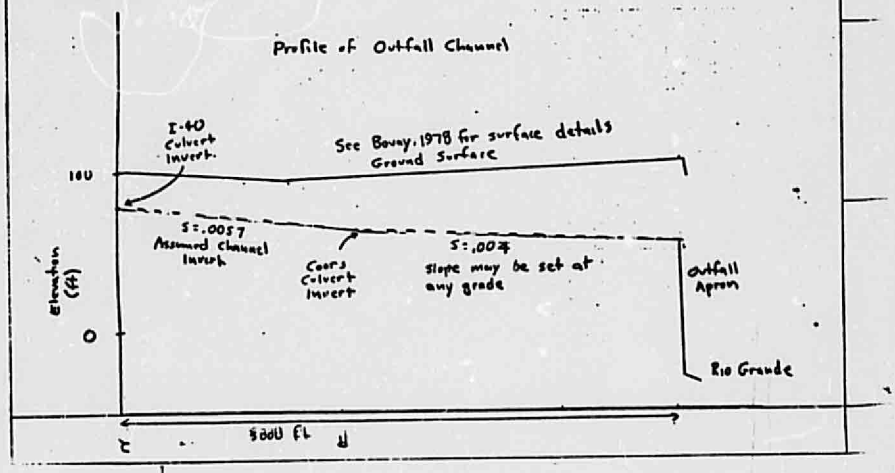

Profile of Outfall Channel
I-40 Culvert Invert.
See Bovey, 1978 for surface details
Ground Surface
100
S=.0057
Assumed Channel Invert
Coors Culvert Invert
S=.007
slope may be set at any grade
Outfall Apron
Elevation (ft)
0
Rio Grande
1 mile

TABLE 3

RN	SB	B	Z	ALPHA	QB	D	A	VN	YN	HC	YC	BC	F	
.0143	3.03173	10.00	2.00	1.03	1833.33	3.70	5.42	9.93	5.46	10.69	5.43	0.30207	0.910	WEST MESA CHANNEL point h
.0143	3.03173	12.00	2.00	1.03	1833.33	3.44	5.58	9.86	5.36	10.61	5.13	0.30206	0.911	
.0143	3.03173	14.00	2.00	1.03	1833.33	3.58	5.34	9.78	5.30	10.51	4.83	0.30206	0.912	
.0143	3.03173	16.00	2.00	1.03	1833.33	3.51	5.29	9.69	4.83	10.43	4.58	0.30206	0.912	Concrete
.0143	3.03173	18.00	2.00	1.03	1833.33	3.44	5.24	9.59	4.63	10.29	4.36	0.30206	0.912	
.0143	3.03173	20.00	2.00	1.03	1833.33	3.37	5.19	9.48	4.39	10.18	4.16	0.30206	0.911	
.0293	3.03173	10.00	3.00	1.03	1833.33	3.83	5.73	9.87	5.57	9.31	5.93	0.30463	0.928	
.0293	3.03173	22.00	3.00	1.03	1833.33	3.79	5.67	9.83	5.39	9.93	5.79	0.30465	0.928	
.0293	3.03173	24.00	3.00	1.03	1833.33	3.74	5.63	9.79	5.22	9.45	5.44	0.30468	0.927	Earth
.0293	3.03173	26.00	3.00	1.03	1833.33	3.70	5.63	9.75	5.06	9.36	5.51	0.30469	0.927	
.0293	3.03173	28.00	3.00	1.03	1833.33	3.66	5.56	9.71	4.92	9.28	5.59	0.30473	0.926	
.0293	3.03173	30.00	3.00	1.03	1833.33	3.61	5.52	9.67	4.78	9.19	5.28	0.30475	0.926	
.0143	3.03793	10.00	2.00	1.03	1983.33	2.58	2.41	16.86	5.67	10.45	5.11	0.30209	1.861	I-40 Interceptor point c
.0143	3.03793	12.00	2.00	1.03	1983.33	2.51	2.36	16.74	5.42	10.36	4.82	0.30209	1.861	
.0143	3.03793	14.00	2.00	1.03	1983.33	2.44	2.31	16.64	5.21	10.26	4.36	0.30209	1.860	
.0143	3.03793	16.00	2.00	1.03	1983.33	2.37	2.26	16.53	5.02	10.15	4.58	0.30209	1.857	Concrete
.0143	3.03793	18.00	2.00	1.03	1983.33	2.30	2.20	16.46	2.85	10.05	4.11	0.30209	1.856	
.0143	3.03793	20.00	2.00	1.03	1983.33	2.23	2.14	16.39	2.71	9.92	3.91	0.30209	1.850	
.0293	3.03793	14.00	3.00	1.03	1983.33	2.77	2.69	16.18	4.05	9.63	4.22	0.30669	1.079	Earth
.0293	3.03793	30.00	3.00	1.03	1983.33	2.41	2.36	16.37	2.96	8.95	3.37	0.30687	1.064	
.0143	3.03573	14.00	0.0	1.03	1533.33	6.09	3.26	17.63	6.00	19.11	7.09	0.30176	1.257	c-d
.0143	3.03573	16.00	0.0	1.03	1533.33	5.37	3.21	17.45	5.37	18.45	6.49	0.30136	1.327	
.0143	3.03573	18.00	0.0	1.03	1533.33	4.84	3.15	17.21	4.86	13.93	6.03	0.30300	1.374	
.0143	3.03573	20.00	0.0	1.03	1533.33	4.43	3.07	16.93	4.43	13.42	5.59	0.30293	1.417	
.0143	3.03573	22.00	0.0	1.03	1533.33	4.10	2.99	16.62	4.13	13.33	5.24	0.30275	1.446	
.0143	3.03573	24.00	0.0	1.03	1533.33	3.83	2.93	16.31	3.83	12.62	4.95	0.30264	1.469	
.0143	3.03203	12.00	0.0	1.03	2233.33	14.69	4.26	12.48	14.69	18.37	15.15	0.30491	0.574	Outfall point d.
.0143	3.03203	14.00	0.0	1.03	2233.33	12.23	4.45	12.83	12.23	17.16	9.16	0.30616	0.647	
.0143	3.03203	16.00	0.0	1.03	2233.33	10.55	4.55	13.03	10.55	16.48	8.37	0.30166	0.707	
.0143	3.03203	18.00	0.0	1.03	2233.33	9.33	4.56	13.13	9.33	15.76	7.76	0.30329	0.755	
.0143	3.03203	20.00	0.0	1.03	2233.33	8.42	4.57	13.17	8.42	15.25	7.21	0.30304	0.794	
.0143	3.03203	22.00	0.0	1.03	2233.33	7.70	4.53	12.99	7.73	14.77	6.77	0.30285	0.825	
.0143	3.03203	12.00	0.0	1.03	2233.33	11.05	5.09	16.03	11.05	18.37	13.14	0.30492	0.880	
.0143	3.03203	14.00	0.0	1.03	2233.33	9.30	5.09	16.03	9.30	17.17	9.15	0.30615	0.977	
.0143	3.03203	16.00	0.0	1.03	2233.33	8.10	4.32	16.98	8.13	16.42	8.38	0.30366	1.032	
.0143	3.03203	18.00	0.0	1.03	2233.33	7.22	4.31	16.93	7.22	15.78	7.76	0.30329	1.111	
.0143	3.03203	20.00	0.0	1.03	2233.33	6.55	3.96	16.93	6.55	15.26	7.22	0.30304	1.157	
.0143	3.03203	22.00	0.0	1.03	2233.33	6.02	3.89	16.61	6.02	14.76	6.77	0.30285	1.193	
.0143	3.03203	12.00	0.0	1.03	2233.33	9.39	5.66	19.51	9.39	18.37	13.15	0.30491	1.183	
.0143	3.03203	14.00	0.0	1.03	2233.33	7.96	5.72	19.75	7.96	17.17	9.15	0.30616	1.234	
.0143	3.03203	16.00	0.0	1.03	2233.33	6.96	5.72	19.75	6.96	16.42	8.37	0.30366	1.319	
.0143	3.03203	18.00	0.0	1.03	2233.33	6.23	5.66	19.61	6.23	15.79	7.76	0.30329	1.384	
.0143	3.03203	20.00	0.0	1.03	2233.33	5.67	5.62	19.39	5.67	15.26	7.22	0.30304	1.438	
.0143	3.03203	22.00	0.0	1.03	2233.33	5.23	5.55	19.12	5.23	14.77	6.77	0.30285	1.473	
.0143	3.03203	12.00	0.0	1.03	2233.33	8.38	5.53	21.97	8.38	18.37	13.14	0.30492	1.3[illegible]	
.0143	3.03203	14.00	0.0	1.03	2233.33	7.13	5.55	22.35	7.13	17.17	9.15	0.30616	1.453	
.0143	3.03203	16.00	0.0	1.03	2233.33	6.27	5.51	21.94	6.27	16.42	8.38	0.30366	1.565	
.0143	3.03203	18.00	0.0	1.03	2233.33	5.63	5.46	21.73	5.63	15.79	7.76	0.30329	1.616	
.0143	3.03203	20.00	0.0	1.03	2233.33	5.13	5.39	21.43	5.13	15.27	7.21	0.30304	1.667	
.0143	3.03203	22.00	0.0	1.03	2233.33	4.74	5.31	21.13	4.74	14.76	6.77	.30285	1.708	

THERODE EXECUTION TERMINATED DUE TO ERROR COUNT FOR ERROR NUMBER 217

THERDIE FIACS - END OF DATA SET ON UNIT 5

TRACEBACK ROUTINE CALLED FROM IBN REG. 14 REG. 15 REG. 0 REG. 1

IHCPY	30307044	30306178	F8777789	01C03030
4BIN	30021582	31300813	FFD03318	30030F58

ENTRY ADDRS 01C00810

FRED DENNEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
2400 COMANCHE ROAD, N.E.
ALBUQUERQUE, NEW MEXICO 87107
(505) 884-0696

K10-D3

July 8, 1981

RECEIVED
JUL 10 1981
CITY ENGINEER

Mr. Chuck Easterling
Principal Assistant City Engineer
Hydrology Department
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Dear Chuck:

Joe Allen, of my staff, just advised me of your refusal to sign off on two of our projects which have been approved by all other City Departments. I am told that you wouldn't sign because you have not yet approved the respective drainage reports. I think a few observations are in order, as follows:

1. El Rancho Atrisco Phase III: A drainage report covering the Sector Development Plan was submitted on March 3, 1981. A more generalized drainage report covering some 3300 acres including El Rancho Atrisco Phase III was submitted well over a year ago with no City action to date. The drainage report of the Atrisco Business Park, which is closely related to El Rancho Atrisco Phase III, has been in various stages of review, revision, and submission for more than two years with the last revised report being submitted to the City on November 12, 1980.

The drainage report for El Rancho Atrisco Phase III provides for ponding and subsequent evacuation. The pond can be eliminated if the improvements proposed by the City Engineer along I-40 are constructed. If those improvements are not forthcoming, the ponds will become permanent. This conforms in every respect to current City Policies. We have demonstrated in substantive detail how the drainage will be managed. There will be at least six, perhaps more, subdivisions in this Sector Plan Area, each of which will require a drainage report which will be subject to your approval.

Several millions of dollars of financing commitment for El Rancho Atrisco Phase III await approval of the Sector Development Plan. The delay, in my opinion, is totally unwarranted.

2. University Heights Hospital: The drainage report was submitted on the 3rd of April. There exists a previous report approved by the City when a New Car Dealership for this property was proposed. The major drainage control structures are already constructed and approved by the City. The change of use from a car dealership to a hospital has reduced the amount of runoff somewhat in that there is less paved area. The revised drainage report reflects these changes.

It has become apparent that drainage is the controlling factor in the development of any property in or near the City. We can make our way through the maze of other City Departments and Agencies and reconcile the problems, time consuming as it may seem. However, we invariably come to the end waiting for drainage.

It seems to me that the development, growth, and prosperity of the City is significantly threatened by this condition. That being the case, the problem simply cannot be allowed to continue.

I am aware of the fact that you are operating with little or no policy guidelines, therefore, everytime you take an action on a drainage report or drainage plan, you are to some degree setting policy. That being the case, I can understand your need to be extremely careful. That not withstanding, the excessive delays cannot be tolerated.

By copy of this letter to several other City Officials, I am suggesting that they may be helpful to you in finding ways to mitigate this problem.

Very truly yours,

Fred Denney

FD/am
cc: Mayor David Rusk
City Engineer Richard Heller
Director of Development Gerald Davenport
Al Candelaria, Westland Development Co., Inc.
The Buchanan Group
Bob Maier, University Heights Hospital

K10-D3

MEMORANDUM OF UNDERSTANDING

RECEIVED
NOV 14 1980
CITY ENGINEER

This memorandum describes the terms of an Agreement between the City of Albuquerque and Westland Development Co., Inc., acting through its executive committee. This Agreement covers matters pertaining to drainage within the Atrisco Business Park and adjacent areas. The parties hereto agree as follows:

A. Westland Development Co., Inc., will:

1. Modify its drainage management plan to include provision for a future storm drainage system to be installed in Atrisco Business Park providing for evacuation of ponding areas. This system will be designed to evacuate the 100 year runoff from the streets and developed areas in a period of not more than 24 hours.

2. Construct the drainage system in increments as the Park is developed and at such time as the City provides an outlet for the system as set forth in Paragraphs 1, 2, and 3 of Section B herein.

3. Implement the ponding system now covered in the drainage management plan in increments necessary for the protection of development as the remaining parcels of the Park are developed.

4. Insure by appropriate covenants reviewed by the City of Albuquerque, that future owners or lessees of parcels in the Business Park will be bound by the provisions of this Agreement and the approved drainage management plan.

5. Maintain or cause to be maintained the ponding system now covered in the drainage management plan. Such maintenance shall not include the piping system in the drainage management plan.

6. Permit the collection of surface flows from public streets within the Atrisco Business Park in the ponding system now covered in the drainage management plan.

B. The City of Albuquerque agrees to:

1. Prepare detailed design and construction contract documents for a diversion channel north of I-40 with an outlet to the Rio Grande, together with a branch system to provide an outlet for the future Atrisco Business Park System south of I-40.

2. Recommend that funds for construction of the diversion channel and outlet system be included in the October, 1981, General Obligation Bond Issue.

3. Immediately initiate actions leading to construction of these improvements upon approval by the electorate of the bond issue.

4. Operate and maintain the storm drainage system for pond evacuation.

5. Approve the drainage management plan prepared by Westland which plan includes a signed copy of this agreement, and accept phased implementation of that plan.

The foregoing describes in general terms the Agreement between the parties. In executing this instrument each party agrees to cooperate with the other party in an effort to acquire the best possible drainage management plan for the Atrisco Business Park consistent with public need.

Executed this 10th day of November, 1980.

WESTLAND DEVELOPMENT CO., INC.

BY: Ramon S. Herrera
Ramon S. Herrera, President

CITY OF ALBUQUERQUE, NEW MEXICO
OFFICE OF THE MAYOR

BY: _____
David Rusk, Mayor

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

November 12, 1980

Mr. Rich Leonard
A.M.A.F.C.A.
P.O. Box 25851
Albuquerque, NM 87125

K-10-D3

Dear Mr. Leonard:

Please find enclosed the latest submission by Fred Denney & Associates, Inc., for Atrisco Business Park for review.

Very truly yours,

Richard S. Heller

Richard S. Heller
City Engineer

RSH/tsl

cc: B. Conegliano, Asst. Hydrology Engineer

MUNICIPAL DEVELOPMENT DEPARTMENT
Richard S. Heller, P.E., City Engineer ENGINEERING DIVISION Telephone (505) 766-7467

City of Albuquerque
P.O. BOX 1293 ALBUQUERQUE, NEW MEXICO 87103

September 15, 1980

Mr. Fred Denney
Fred Denney & Assoc.
5643 Paradise Blvd. N.W.
Albuquerque, New Mexico 87114

RE: DRAINAGE REPORT FOR THE ATRISCO BUSINESS PARK

F10-D3

Dear Mr. Denney:

Given the scope of the referenced project and its potential impact on the community, I am duty bound to raise as issues all the points that I feel could adversely affect the community, both in terms of protection against flooding and of the financial burdons that the City would have to bear for this project in the face of the other drainage needs of the community. In reply to your letter dated September 3, 1980, first of all I want to point out that the drainage report which had been approved in 1974, cannot be used as a basis for discussion, since too many changes, both in physical facilities constructed and in philosophy have occurred since that approval was given. As you know, plats must be initialized if a year's time has elapsed from the date of the original signature, to demonstrate the continuing concurrence of all the parties involved.

One matter that was of concern to me in the review of the revised drainage report, was the lack of any acknowledgement of the requirements for approval, stipulated by the City Engineer with his memorandum to Gene Mares dated 5-1-80 (see attachment) The indications furnished by this office must be followed, unless they are proven to be technically and economically unfeasible; otherwise the drainage report must supply a detailed outline of the methods used to comply with the requirements.

In regard to your reply to the technical aspects of my commenrs, I doubt that Mr. Heller may have agreed to a time of evacuation of 72 hrs., particularly since last November he issued the interim drainage guidelines, which called for an undeveloped Q_5 rate of release from any detention area (outside of the Valley where more stringent requirements apply). Such release rate insures the drainage of the detention areas, in less than 6 hours; also this approach does not require excessive expenditures for large storm sewer systems, which can be designed instead for reduced and controlled flow rate. Further, this approach minimizes the safety problems accruing to the public, due to the existence of large retention areas, and limits the possibility of structural damages to both private and public facilities due to infiltration and settlement.

It is your claim that my demands are utterly unreasonable; "for what do we design, 100 year storm event or for some infinite variety of storm events which might be conceived?" I will, therefore, refer you to the U.S. Weather Bureau Technical Paper 49, published in 1964, which provides information on the type of precipitation which can be expected in Albuquerque, for durations of up to 10 days and with frequencies of recurrence up to 100 years. There, you will find that the precipitation for the 2 days, 25 years event is given in 3.5 inches and for the 2 days, 100 years event the total precipitation approaches 5.0 inches. In the light of these figures, the drainage of the ponds over a 72 hour time period, with a design for a total precipitation of 2.2 inches, appears unreasonable.

Further, I do not see how, given the published interim standards, can the City accept provisions for the Atrisco Business Park, which are different than what is requested of the rest of the Community.

Regarding the technical point 2, I note that plate 3 in the report bears the indication "Final Grading Plan". On that plan there is no indication of any provisions for the handling of the runoff generated by all the parcels to be developed, either before or after development. Further, point one of the memorandum of understanding, does not distinguish between private and public ponds but states simply, that the ponding areas will be supplied with positive drainage.

I will stress again the fact that, before the City grants approval to a drainage report, clear indications must be given on the method for handling the runoff generated by this development, which according to the date furnished by you, will exceed 100 ac. ft. If staged development is planned, interim measures to control the undeveloped runoff must be furnished to prevent damages to both private and public facilities.

In regard to point 3, I disagree with your assessment. The field data gathered by the U.S.G.S., presented in the paper "Small Stream Flood Frequency Relationships For the Central Rio Grande Valley of New Mexico" allow the following 100 year peak discharge estimates for the 179 acre watershed and for the 282 acre watershed respectively:

a. Watershed No. 1 Q_{100} = 624.9 cfs.
b. Watershed No. 2 Q_{100} = 809.3 cfs.

The use of the area discharge graphs prepared by the U.S.C.E. from unit hydrograph studies for the West Mesa, produces lower peak discharges than the estimates derived from the U.S.G.S. data and specifically:

a. Watershed 1 Q_{100} = 308 cfs.
b. Watershed 2 Q_{100} = 440 cfs.

These peak discharges are almost identical to my evaluations. Since natural occurrences have repeatedly demonstrated the fallibility of our modelling efforts, in matters of public safety I advocate a reasonably conservative approach in the provision of flood protection facilities.

On your point 4 I note that since the Flood Control Authority, through the construction of the Ladera System, has substantially reduced the offsite flows impinging on this property, in view also of the existence of substantial depression on this site, the City cannot concur with your suggestion to allow the excess flows to continue in a Southerly direction. If we were to follow your recommendation, what would be the use of designing and constructing protection facilities?

Regarding point 5, I want to note that final grading plan on plate 3 does not indicate a pond no. 6. There is some flow from Bluewater Rd. directed to pond no. 5 (R.O.W.?) but the length of the street, as scaled from the grading plan, is no more than 700 ft. Incidentally, given the final contours shown on the plan, and a bottom of pond elevation of 87.0 ft. it may be very difficult to detain any water in pond no. 5.

Notwithstanding the most sincere desire on the part of the City to cooperate with the Westland Corp., for all the reasons stated above, I reiterate that it is not possible for this office to grant approval to the referenced drainage report.

If you feel that you cannot comply with the requirements stipulated in the memo to Gene Mares and with my observations, please set up a meeting at your earliest convenience with Mr. Gerald Davenport, Mr. R. S. Heller and myself to resolve the problems discussed in this and in previous correspondence.

Very truly yours,

Bruno Conegliano
Asst. City Engineer-Hydrology

BC/tsl

Attachment

cc: R. S. Heller, City Engineer
Richard Leonard, AMAFCA
G. D. Davenport, Director/M.D.D.
Al Candelaria, Westland Corp.

City of Albuquerque, New Mexico
Engineering Division

RSH ___ ADM ___
PRO ___ SUR ___
CONS ___ COUN ___
DES ___ SEC ___
INSP ___ FILE ___
HYDRO ___ RETURN ___

Memorandum - May 1, 1980

TO: Gene Mares, Principal Planner

FROM: Richard S. Heller, City Engineer

SUBJECT: Atrisco Business Park Master Plan

The drainage concepts presented by the master plan, are not acceptable to the City Engineer's Office. Specifically:

1. All offsite flows entering the study area both from the north and the west must be collected with appropriate drainage facilities and must be treated in a manner approved by the City Engineer. The off-site detention area, to the west of the development, is presently outside the City's jurisdiction. The storage capability of that facility must be consistent with the ultimate development of the watersheds intercepted (the appropriate inflow outflow hydrographs must be supplied and found satisfactory by the office of the City Engineer.) At this time the City cannot accept the responsibility for the maintenance of the detention area. Therefore, legal means must be devised to insure the permanence of the detention area and to guarantee to the City its maintenance by the developer until all the flows north of the Freeway are intercepted as recommended by Dr. Heggen's report.. The approach of the master plan which anticipates that the excess runoff of the more infrequent storms, will continue to the east and south along preexisting flow paths, is not acceptable in an urbanizing area. The concern expressed here is that the overflow of the detention facility could affect the light industrial area shown on the master plan.

2. The drainage concept for the individual parcels within the development, which envisions onsite ponding with no maintenance nor liability responsibility for the City, is acceptable provided that all such detention ponds have positive outlets. While we recognize that playas with no natural outlets occupy a significant portion of the master planned area, the intended development will obliterate said natural storage ponds. Therefore, an equivalent volume must be supplied, but an outlet must also be provided for the safe disposal of the excess runoff.

3. Storm runoff from public streets may not be discharged onto private ponding area; the streets must be regraded to convey the runoff to the eastern side of the tract and thence

north to the northeast corner, where the City will eventually construct an outfall to the Rio Grande River. The committment by the City to provide an outfall for this area has been discussed with representatives of the Westland Development Corporation. This design approach was previously indicated to the developer's Engineer, and is in accordance with the result of the study performed by Dr. Heggen, which has been made available to the consultant. This approach is also consistent with previously adopted West Mesa Drainage Concepts.

Therefore, the City will design the outfall facility, to collect the runoff from the Atrisco Business Park, including the street runoff, the storm runoff discharged in a controlled manner from the private detention areas and the runoff entering the Atrisco Business Park from the north and west.

Since the construction of the facilities is contingent upon voters approval, the drainage plan must suggest interim solutions that will suffice until the necessary funds become available to the City. A review of the capability of existing facilities east of Coors Blvd., indicates that Bluewater outfall storm sewer is not available for any service to this area, and this condition must be recognized in the provision of the interim solution as well.

Regarding the street pattern, we would like to suggest a more direct east-west orientation of Los Volcanes Road, and the intersection into those major roads without curvilinear alignment (as shown on the plans for each road midway in the development.)

FRED DENNEY & ASSOCIATES, INC.
CONSULTING ENGINEERS
2400 COMANCHE ROAD, N.E.
ALBUQUERQUE, NEW MEXICO 87107
(505) 345-8852

September 3, 1980

RECEIVED
SEP 04 1980
CITY ENGINEER

K10-D3

Mr. Bruno Conegliano
Assistant City Engineer
Hydrology
City of Albuquerque
P.O. Box 1293
Albuquerque, NM 87103

Re: Atrisco Business Park
Master Drainage Plan
F.D. Job No. 451.12

Dear Mr. Conegliano:

I have reviewed your letter of 18 August, 1980, pertaining to subject plan, and am considerably dismayed by it. It appears to me that you have ignored all the studies, meetings, and agreements which have occurred during the last nine months and have effectively returned to square one.

First I will reiterate some general observations, after which I will deal with your technical comments.

1. There is an approved drainage plan for the business park. That plan is based on ponding with no offsite facilities.

2. The approved plan was revised to reflect the change in the development plan. In the original report a 100% retention ponding solution was recommended. In my letter to Dick Heller dated April 18, 1980, I stated that in my judgement the City had no valid basis for rejecting that plan. I still believe that to be so.

3. However, the City felt and apparently still feels strongly that a hardware system is preferable.

4. After a series of meetings, some of which were attended by Mayor Rusk, Mr. Davenport, and Mr. Heller, the Westland Board agreed to provide a minimum storm sewer system to drain the ponds over a period of time. Seventy-two hours was selected and is stated in the Agreement between the City and Westland now awaiting signature.

Now to the technical aspects of your comments:

1. You take exception to the 72 hour evacuation period. I believe that the City has already approved it. You suggest that two successive storms of less than 100 year frequency would overtax the system. What is the probability of that? For what do we design, the 100 year storm or some infinite variety of storm events which might be conceived?

2. Apparently you failed to read the report. The 8.84 acre feet is for street runoff only. 100% of the runoff from each tract is to be retained onsite. See Page -2-.

3. The velocity and time of concentration are computed over the entire watershed, not just for the length of the proposed new channels. The velocity across the watershed produces the time of concentration shown. The time of concentration and peak flows, as shown in the report, are correct.

4. You are correct in that 52 acre feet of ponding is available on the site presently, as shown on Plate 2. However, none of the offsite flows which we are showing to be impounded in Pond A can reach any of the available existing ponding areas. Any flows in those arroyos presently traverse the property and exit at Unser Boulevard. Admittedly no water has exited the site for the last several years, but I can recall one event, and I don't remember exactly which year, where it did in fact exit the site at the present Unser Boulevard. There is some State Highway Department data on this if you should like to search it out. The fact that the 100 year storm is being stored in Pond A, effectively precludes exit in the future except in events greater than 100 year.

5. Flow to Pond 5 is from Bluewater as is clearly shown on Plate 3. The 1575 foot dimension you cite is for Pond No. 6 as is clearly stated.

The volumes computed are based on average top and bottom areas. It's the volume that is important. This is a report, not a construction drawing.

I take exception to your statement that information is insufficient. Plate No. 3 clearly shows how the streets drain, and to where. This is easily relatable to the computations.

6. You state the storm sewer should be constructed with the streets. It can't be until the City System is in place. Dick Heller and I agreed, and Westland agreed to construct the system back of the curbs on streets existing at the time the City's outlet is completed.

I believe the Memorandum of Understanding has been approved. If not, both we and the City have wasted a great deal of time drafting and redrafting.

I will indeed contact Mr. Heller about this matter.

Very truly yours,

Fred Denney

Fred Denney

FD/am
cc. Dick Heller
Rich Leonard
Gerald Davenport
Al Candelaria

City of Albuquerque, New Mexico
Engineering Division

Memorandum - May 1, 1980

TO: Gene Mares, Principal Planner

FROM: Richard S. Heller, City Engineer

SUBJECT: Atrisco Business Park Master Plan

The drainage concepts presented by the master plan, are not acceptable to the City Engineer's Office. Specifically:

1. All offsite flows entering the study area both from the north and the west must be collected with appropriate drainage facilities and must be treated in a manner approved by the City Engineer. The off-site detention area, to the west of the development, is presently outside the City's jurisdiction. The storage capability of that facility must be consistent with the ultimate development of the watersheds intercepted (the appropriate inflow outflow hydrographs must be supplied and found satisfactory by the office of the City Engineer.) If this solution is acceptable and the City can assume the responsibility for the maintenance of the detention area, the pertinent R.O.W. must be conveyed to City. The approach of the master plan which anticipates that the excess runoff of the more infrequent storms, will continue to the east and south along preexisting flow paths, is not acceptable in an urbanizing area. While a 100 yr. frequency design is acceptable for channels which follow their natural alignments, liability problems arise with diversions. Therefore, sufficient freeboard may be required for the containment of the S.P.F., but on this issue the advice of the City Attorney may be necessary.

We don't want to mention we need a guarantee that it will be pursuant

departs from original concept

we will tell them

2. The drainage concept for the individual parcels within the development, which envisions onsite ponding with no maintenance nor liability responsibility for the City, is acceptable provided that all such detention ponds have positive outlets. While we recognize that playas with no natural outlets occupy a significant portion of the master planned area, the intended development will obliterate said natural storage ponds. Therefore, an equivalent volume must be supplied, but an outlet must also be provided for the safe disposal of the excess runoff and to provide for a positive discharge. The overall drainage concept as submitted with full runoff retention, may also infringe on downstream Water Rights and care must be exercised to prevent conflicts with the requirements of the State Engineer.

we did not say that first time around

what do we care

3. Storm runoff from public streets may not be discharged onto private ponding area; the streets must be regraded to convey the runoff to the eastern side of the tract and thence

north to the northeast corner, where the City will eventually construct an outfall to the Rio Grande River. The committment by the City to provide an outfall for this area has been discussed with representatives of the Westland Development Corporation. This design approach was previously indicated to the developer's Engineer, and is in accordance with the result of the study performed by Dr. Heggen, which has been made available to the consultant. This approach is also consistent with previously adopted West Mesa Drainage Concepts.

Therefore, the City will design the outfall facility, to collect the runoff from the Atrisco Business Park, including the street runoff, the storm runoff discharged in a controlled manner from the private detention areas and the runoff entering the Atrisco Business Park from the north and west.

Since the construction of the facilities is contingent upon voters approval, the drainage plan must suggest interim solutions that will suffice until the necessary funds become available to the City. A review of the capability of existing facilities east of Coors Blvd., indicates that Bluewater outfall storm sewer is not available for any service to this area, and this condition must be recognized in the provision of the interim solution as well. Regarding the street pattern, we would like to suggest a more direct east-west orientation of Los Volcanes Road, and the intersection into those major roads without curvilinear alignment (as shown on the plans for each road midway in the development.)

ENGINEER'S STUDY ON STORM DRAINAGE

UNIT NO. 2 - ATRISCO BUSINESS PARK

Prepared for

WESTLAND DEVELOPMENT CO., INC.

PURPOSE AND SCOPE: The purpose of this study is to present the results of a comprehensive analysis performed to define a Drainage Plan for Unit No. 2 of Atrisco Business Park. The following are the most significant aspects of the Plan:

1. Provision that onsite storm runoff rates and amounts after development do not exceed those of present day conditions. This can be accomplished by the retention-infiltration of excess rainfall on individual sites in accord with the plat statement; each development plan for this SU-1 zoned subdivision requires the review of the City and A.M.A.F.C.A.
2. Accepting offsite storm runoff at present day locations and providing carrying facilities adequate to convey runoff to existing outfall locations.
3. Assigning locations and sizing excavated Detention Ponds Nos. 1 and 2 to replace natural onsite ponding; these two ponds along with other ponds shown will serve to significantly decrease the peak flow rates into possible interceptor channels. The outflow pipes shown along with infiltration, must empty the ponds within the required 96 hours. Until some type of interceptor facilities are provided, natural or constructed ponds should be retention-infiltration ponds.

4. Reserving platted corridors and developing feasible preliminary designs for low-velocity excavated earth interceptor channels along the perimeter of the Park. The interceptor channel design along the south line of the Park is based on handling that runoff which at present would enter or be generated in the Park if no flow crossed I-040. If storm drainage from additional areas are to be included, then offsite ponding, channel section modification, lining of channels or acquisition of additional right of way from adjacent owners will be necessary.

   Public Agencies have long planned to relieve flooding south and east of this subdivision. Although specific treatments have not as yet been determined, Westland has reserved corridors for implementation of such plans.

5. Phasing of onsite drainage facilities dependent on protection work by others.

STUDY AREA: The study area consists of Unit No. 2 of Atrisco Business Park, a proposed subdivision in Bernalillo County, New Mexico. The Park lies adjacent to and northerly and westerly from the recently platted Unit No. 1 of Atrisco Business Park and comprises the remaining portion of the Cutter-Carr Airport. The study area contains approximately 600 acres of semi-arid sandy lightly grassed lands draining generally both easterly to outfall at Coors Boulevard near Fortuna Road and also southeasterly to outfall at the southerly line of the Park. (See Exhibit A) The westerly three-quarters of the study area is characterized by arroyos sloping generally southeasterly at two percent gradient and the remainder of the lands are essentially flat.

GENERAL: Westland Development Co., Inc. is engaged in master-planning their extensive holdings in the Town of Atrisco Grant on Albuquerque's west mesa. As an initial step in the orderly development of their lands, Westland has secured the City Planning Commission's approval of a Master Plan of roads and land use for Atrisco Business Park. As shown on the Master Plan, the Park will be essentially a commercial-industrial area, the development of which, like that of other Albuquerque industrial areas, is anticipated to occur over a time span of perhaps 15 to 25 years. The likelihood of changes in market over this period indicates that the committment of interior property lines be best held to a minimum at this time.

The subdivision plat with which this drainage plan is associated is therefore essentially a road dedication plat showing four arterial streets whose location is fixed by existing conditions. It is the intent that these arterials provide primary access to areas suitable for development and that interior streets will be dedicated as the pattern of desired direction of development emerges. These streets, governed by topography, will be located to observe the basic drainage pattern shown on Sheets 1 and 2 of Drainage Plan.

Insofar as this study is concerned, the determination was made that all facilities shown are designed to accomodate the 100 year return frequency storm and that;

1. Local storm drainage will be carried in streets flowing up to 0.20 feet above the top of curb; lands lying immediately back of the curb are to be at least one foot higher than the top of curb.
2. Interior drainage channels shall be low slope - low velocity

excavated earth channels.

3. Ponds shall be provided with spillways designed to convey runoff in excess of that for the 100 year storm, shall be no more than five feet deep to spillway elevation and shall have two foot freeboard when built with embankment.

4. Excavated earth interceptor channels shall have adequate freeboard to protect from more extreme occurances than the 100 year storm.

In all cases, it is assumed that either contributing lands are in the natural state or that present policies will restrict developed runoff to no more than that of land in the natural state.

HYDROLOGY: The type of storm used in this study is the high early peak two hour orographic uplift storm defined by Yarnell's Curves as adapted for Albuquerque, New Mexico and incorporated in the Albuquerque Master Plan of Drainage. (See Plate 1.) This storm is used to design storm drainage carriers by use of the Rational Formula, Q = AIR which "Q" is the peak flow in cubic feet per second, "A" is the contributing drainage area in acres, "I" is the intensity of rainfall and "R" is the coefficient of runoff. "A" has been determined by measurement of the drainage areas shown on the Drainage Plan. "I" has been read from Plate 1 after determining the time of concentration for each area. The total time of concentration is the sum of initial and carrier times of concentration. Initial time of concentration in hours was determined by the California Culverts Practice Formula $Tc = C \left(\frac{11.9 \times L^3}{H}\right)^{0.385}$ where C is a coefficient dependent on the type of hydraulic section conveying runoff to the carrier, "L" is the length of watershed in miles and "H" is the elevation difference of the watershed in feet. The carrier time

was determined based on velocity of flow in the carrier. "R" has been estimated at 0.35 for all contributing areas. Estimated peak rates of carrier runoff (along with "A" and "I") shown on the Drainage Plan are based on the Rational Formula.

Total 24 hour runoff into ponding areas was also determined using the Rational Formula. Reading the 100 year rainfall basin average rainfall rate at the end of two hours at 1.30 inches/hr, assuming that 90% of the 24 hour rainfalls in the first two hours and utilizing the 0.35 runoff factor "R", we have determined the total two hour runoff to be;

$$2 \times \frac{189}{25 + 120} \times 0.35 \times 0.90 = 1.01''$$

?

This amount of runoff, decreased by two hour pipe outflow, was used to design pond storage capacity. Runoff determined by this approach is conservative by comparison with amounts determined by Soil Conservation Service methods for corresponding runoff conditions.

DEVELOPMENT OF THE PLAN: The first step in developing the plan was to determine existing conditions including drainage divides and Interstate Highway 40 crossroad conduits. This was done and is shown on a base map prepared from an enlarged U.S.G.S. Quadrangle Sheet. (Exhibit A) The next step was to transfer drainage areas north of Interstate Highway 40 from highway plans for the individual crossroad conduits and to measure remaining areas south of I-040. The total areas as accumulated are shown in rectangles on Exhibit A. At this step, it became evident that the I-040 potential flow from drainage areas "C" and "D" would present a problem. Further office and field investigations indicated that the arroyo flow from these drainage areas fans out on an alluvial plain with the possibility

that the thalweg could change with large rainfalls. We therefore recommend that development and arterial extension within these two drainage areas be such as to minimize disturbance of the existing drainage pattern until such time as the potentially large flows are intercepted upstream or conveyed away from the subdivision by constructed carriers.

The next step was to determine existing potential peak flow into and through the Park by means of the Rational Formula and note on Exhibit A.

Assumptions were then made as to the drainage patterns after this subdivision and adjacent lands are developed, essentially retaining existing drainage divides and utilizing streets as storm carriers; straight line drainage divides were drawn, areas were measured and shown on Exhibit A and the Drainage Plan. Areas entering the subdivision were assumed cut off at Interstate Highway 40. These are the encircled areas shown both on Exhibit A and on the Drainage Plan for correlation between the maps.

The next step was to compute peak and total runoff for fully developed areas both within and outside the park and enter on the Drainage Plan. Ponds were then sized in accord with the criteria noted under "HYDROLOGY" and type and size of storm drainage carriers were determined and shown on the Drainage Plan.

In all cases, analysis of hudraulic sections for carriers were based on Manning's Formula, $Q = \frac{1.486}{n} S^{\frac{1}{2}} R^{2/3} A$, where n = 0.015 for paved sections and 0.030 for earth channels.

Street grading controls are shown for the entire Drainage Plan and in addition, a basic tract grading plan is shown for the flat

lands east of Airport Road. This grading plan was done for two reasons; both to provide interior storm drainage protection to these lands by elevation control and to assist the owner in land planning.

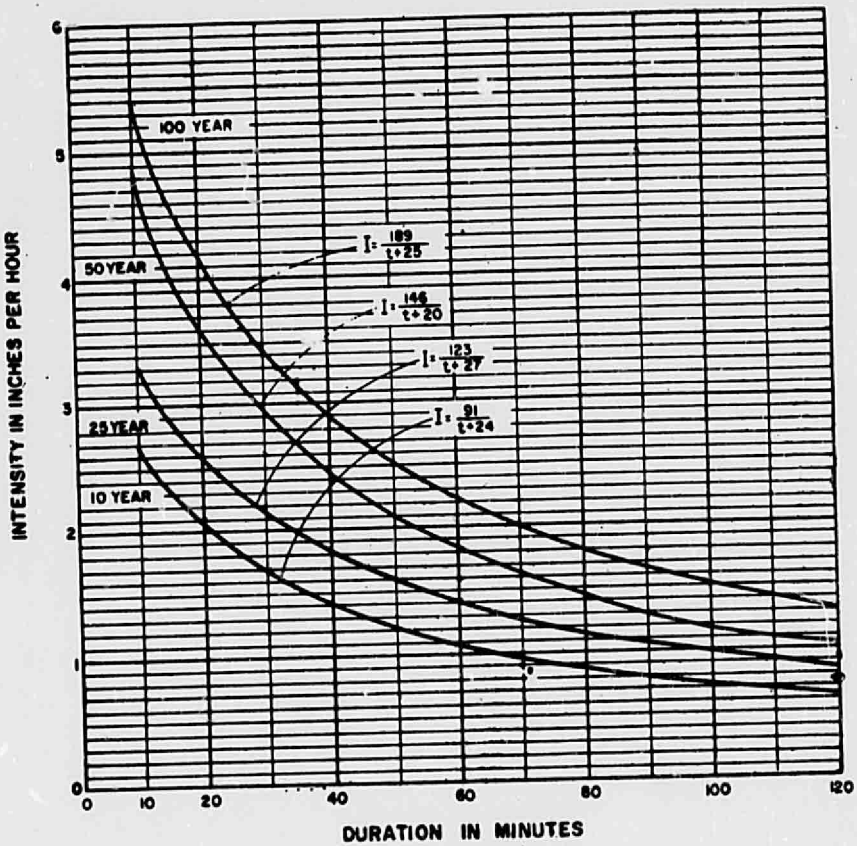
Phasing is shown on the plans to indicate one likely sequence of construction of drainage facilities. This was done primarily in order to set aside sufficient lands for future needs. We recognize that plans for public facilities on the west mesa are in the initial stage of development; however, we have confidence that protection will be provided.

We emphasize that with;

1. Required onsite detention-infiltration
2. Existing or constructed ponding
3. Retention of existing drainage divides
4. Controlled development within drainage areas "C" and "D",

growth of this subdivision will not aggravate storm flow conditions downstream.

CONCLUSION AND RECOMMENDATIONS: We recommend that this drainage study be adopted for Unit No. 2 of Atrisco Business Park with updating to follow public agencies determinations as to the scope and details of protection for adjacent owners.



INTENSITY DURATION FREQUENCY CURVES

PLATE I

ENGINEERS REPORT

FOR

ATRISCO BUSINESS PARK

Prepared For

WESTLAND DEVELOPMENT CO. INC.

ALBUQUERQUE, NEW MEXICO

OCTOBER, 1972

GORDON HERKENHOFF and ASSOCIATES, INC.
ENGINEERS
albuquerque

PLANNERS
santa fe

ENGINEER'S REPORT FOR ATRISCO BUSINESS PARK

I N D E X

LETTER OF TRANSMITTAL

PURPOSE AND SCOPE

GENERAL

DEVELOPMENT AND MANAGEMENT PHILOSOPHY

PUBLIC AGENCY RESTRICTIONS AND REQUIREMENTS

a) General

b) Planning Department

c) Department of Public Works

(1) Water Division

(2) Sewer Division

(3) Traffic Engineering Division

(4) City Engineer

d) AMAFCA

THE MASTER PLAN

DEVELOPMENT PLAN

PHASING OF DEVELOPMENT

DEVELOPMENT COST ESTIMATES

LAND VALUES

COST AND INCOME FORECAST

CONCLUSIONS AND RECOMMENDATIONS

GORDON HERKENHOFF and ASSOCIATES INC.
ENGINEERS
albuquerque

PLANNERS
santa fe

September 29, 1972

Mr. Ramon S. Herrera, President
and Members of Board of Directors
Westland Development Company, Inc.
1327 Bank of New Mexico Building
Albuquerque, New Mexico 87101

RE: ATRISCO BUSINESS PARK

Ladies and Gentlemen:

We are pleased to transmit herewith our report on your ATRISCO BUSINESS PARK. In the sections which follow, we present a plan for the development of this center which we believe reflects sound planning, engineering and management methodology and which also reflects the Board's philosophy in creating this significant development in the West Albuquerque area.

We take this opportunity to acknowledge and express our appreciation for the fine cooperation and assistance which has been provided us by President Herrera, Office Manger-Jaime Alonzo and Consultant-Faustin Guerin. We are also grateful for the help provided us by the officers and staff of the Albuquerque Industrial Development Service and the Albuquerque Industrial Fund Agency.

We believe that development of this plan as presented herein can be of substantial financial benefit to the Westland Development Company, Inc. and to its stockholders, the heirs of Atrisco. The development will benefit the residents of the West Side, particularly those residing in the Southwest Valley and in addition will be of substantial benefit to the development of the Albuquerque Metropolitan area.

We believe that after you have studied this report, a meeting with the board to explain the procedure and answer questions will be helpful. We are prepared to appear at any time you direct.

Upon approval of this report by the Board, we will prepare the brochure to be used for sales and promotion purposes in accordance with the terms of our contract.

Our report follows.

Fred N. Denney

FRED N. DENNEY
ab

302 eighth street n.w.
albuquerque, new mexico
ph. 247-0295
87101

ENGINEER'S REPORT

ATRISCO BUSINESS PARK

1. PURPOSE AND SCOPE: The purpose of this report is to present the results of studies and analyses which have been performed in preparing a master plan of development for the ATRISCO BUSINESS PARK located on approximately 680 acres of land owned by the Westland Development Company, Inc. and known generally as the old Cutter Carr or West Mesa Airport.

2. GENERAL: The development plan has been prepared at the direction of the Westland Development Company, Inc. Board of Directors and reflects that board's objective in developing the property for industrial, commercial and high density residential use. The objective is to maximize the yield from the property to the corporation and, therefore, to the heirs of Atrisco.

During the planning period, options have been signed for two parcels of property comprising 60 acres for development as manufacturing sites. These tracts are fixed and, therefore, it has been necessary to develop the plan around them.

The Albuquerque West Mesa has been slow in developing as compared to the East Mesa. The original town was established east of the Rio Grande and development to the west was probably limited by the problem of access across the river. The establishment of the two military bases during World War II added to the desirability for growth on the east side. From there the growth progressed by the attraction of proximity of development. It was easier and more economic to extend development rather than to jump across the river to an essentially undeveloped area. The fact that the greatest part of the land was held by the heirs of Atrisco has also been a restraint on growth until this time.

Construction of the I-40 freeway across the river marked the start of a change in the growth pattern. This coupled with the approaching shortage of land on the east mesa and the developments of the Horizon Corporation and Rio Rancho to the north clearly indicates that growth in the Albuquerque area in the last part of this century will be largely West Mesa oriented. The fact that Westland Development Company, Inc. is the owner of the bulk of this property places Westland in a commanding position.

3. DEVELOPMENT AND MANAGEMENT PHILOSOPHY: The Board of Directors has indicated to us that we are to develop this plan within general guidelines as follows:

a) Obtain maximum economic return to Westland and, therefore, to the heirs of Atrisco.

b) In planning development, give primary emphasis to the creation of jobs, community progress and other considerations which will serve to improve the economic well-being of the residents of the southwest valley.

c) Create a pleasing appearance in all areas, incorporating good planning techniques, providing open space and particularly limiting the development to clean industry and public oriented business activity.

d) Provide the maximum opportunity for the leasing of property by the Corporation, limiting land sales to that necessary to create a leasing market.

e) Provide in the plan the flexibility for Westland to actually engage in construction of buildings and businesses to be leased or operated by the Westland Development Company, Inc.

f) To fully cooperate with all City, County and State agencies in the planning process to insure that

the development conforms to approved comprehensive plans and that the activity of Westland conforms with and compliments the development of the metropolitan area as a whole.

This, then, is the Westland philosophy and it is to these guidelines and to these objectives that we have dedicated our efforts.

4. PUBLIC AGENCY RESTRICTIONS AND REQUIREMENTS:

a) General: In this day and age, private development is subject to a multitude of regulations and requirements imposed by city government and to a lesser degree by state and federal agencies. We must accept these regulations if we are to receive the benefit of municipal services which are essential to the development. We cannot obtain city services without annexation. As a condition of annexation, the city will require that we conform to the regulations and policy. The requirements of the various departments are discussed in detail as follows:

b) Planning Department: The Planning Department is concerned with the effect of the proposed development on adjacent property and on the city as a whole.

HYDROLOGY K10/D3 11 PLANS 2 of 2

The department deals directly with land use planning and functions as a clearinghouse for insuring that the requirements of all other departments and agencies are met.

It has already been agreed that annexation and simultaneous zoning of SU-1 for a planned commercial and industrial complex will be requested. The general plan has been discussed with the Planning Department staff and they have agreed in principal with the development plan.

It should be emphasized that in accepting the zoning (special use), the Planning Department must review and approve each and every proposed development before a building permit will be issued. Every company who purchases or leases property from Westland must submit its development plan and obtain approval before building will be allowed. Westland also, if it decides to build buildings for lease or to operate businesses, will have to submit and obtain approval of the individual site development plans. We have found the Planning Department staff reasonable and indeed they frequently contribute expertise which produces a better plan, not only for the public but also in the best interest of the developer.

c) Department of Public Works: This department has several divisions which have requirements pertaining to annexation and zoning. It has authority relative to water, sanitary sewer and streets and shares responsibility for drainage with the Albuquerque Metropolitan Flood Control Authority (AMAFCA).

(1) Water Division: The Water Division must approve the internal pipe network design and method of serving the area. Also the Water Division must determine that there is adequate production, storage and main line capacity to serve the proposed development. If they find these facilities inadequate, they may request that development be deferred until these facilities can be provided by the city or the developer may advance these costs if he determines that is in his interest.

Typically the developer pays the cost of building water lines six inches in diameter and smaller and the cost of service lines and meters. The city pays the extra cost of lines over six inches in diameter and the cost of master plan facilities, i.e., wells, reservoirs and pump stations.

In the case of the ATRISCO BUSINESS PARK, the City Water Division currently has no funds to pay its

share of oversize lines. Therefore, it seems likely that Westland will have to advance these costs and be reimbursed when city funds become available.

The availability of water on the West Mesa is limited. The city needs to spend substantial amounts of money to insure the adequacy of water service to the area to meet anticipated growth. We are currently working with the city to get this work started and are confident that an adequate quantity will be available to serve the ATRISCO BUSINESS PARK as it develops.

(2) Sewer and Liquid Waste Division: This division functions much as the Water Division. The developer pays the cost of eight inch diameter lines and building service lines and the city pays the added costs of larger lines, lift stations and treatment facilities. Like the water system, Westland may have to advance the cost of oversize sewers and be reimbursed later.

(3) Traffic Engineering: The Traffic Engineering Division controls the widths of streets, and the geometry of connections to the existing street system. Thus, the division in effect dictates the width of street right-of-way which must be dedicated by the developer.

When this project was discussed with the Traffic Engineer, he indicated he would like to see the streets developed with wide medians. We objected to this since the actual way the property will be subdivided is unknown and the cutting of medians in the future is an expensive burden to be borne by the developer. We have recommended and he has tentatively and reluctantly agreed to providing 48 foot streets to be constructed on 64 foot right-of-way.

As a condition of plat approval, the Traffic Engineer will require that the strip of Westland land east of Coors Road be dedicated, a 20 foot strip south of Fortuna Road be dedicated and that a 50 foot strip west of Coors be reserved for future widening.

Traffic Engineering shares with the Metropolitan Transportation Planning Agency (MTP) which is a division of the Middle Rio Grande Council of Governments, the responsibility for expressway and major arterial planning.

The currently approved thoroughfare plan provides that Coors Road will, in the future, be a limited access highway. However, we are advised by MTP

that that agency will shortly recommend that this plan be revised to make Coors an arterial street and that 78th Street which bisects the ATRISCO BUSINESS PARK become a limited access highway. If 78th Street is developed with no access to Westland property, it will greatly reduce the future value of the property for the purposes proposed. We have obtained preliminary agreement with MTP to provide a slip ramp type of access to the property from 78th Street and therefore its connection from I-40.

In the Master Plan, we have indicated the future right-of-way requirements of this road. However, we do not propose dedication at this time. We will recommend dedication at such time as Westland has contractual assurance that if dedicated, suitable access to the property will be provided when the highway is built.

Some may ask why dedicate this relatively large piece of land for a highway. Why not make the public agency buy it? If the right-of-way is purchased or condemned, then the road building agency will be free to build the highway with no access to the property. If this happens, the damage to the property will greatly exceed the value of the land dedicated. So we will recommend dedication in the future provided satisfactory access is assured.

(4) City Engineer: The City Engineer has many duties with the principal ones affecting this project being drainage, a responsibility shared with AMAFCA, and the structural design of the streets and appurtenant facilities.

He will require assurance that the streets drain properly and that the pavement thickness is sufficient to handle the traffic load to be imposed on it. We see no problem in meeting the City Engineer's requirements.

d) AMAFCA: This agency, which extends outside the city limits, has responsibility for the overall drainage and flood control works while the city is responsible for local drainage However, there has recently been promulgated regulations which give AMAFCA plat and subdivision approving authority on the basis that subdivision planning has significant effect on the overall drainage planning.

These regulations give a great deal of authority to the Executive Engineer. He has taken the position that in general, the developer must not increase the amount of runoff leaving his property over that which occurs in its natural or undeveloped state. This imposes some

severe restrictions on development and may, in some cases, render development uneconomic.

The drainage problem in developing the ATRISCO BUSINESS PARK is significant. A substantial area northwest of I-40 drains into the area. Much of this is ponded on the property and only when the ponds are full does it overflow to the east and south. Thus, the area as it now exists, provides some protection to downslope occupants.

The City of Albuquerque has adopted a Master Plan of Drainage prepared by our firm which provides an interceptor channel along the north side of I-40 and an intermediate channel west of Coors Road terminating within the area proposed for development If these facilities were built today, the drainage problem would be relatively simple. However, they are not built and it is doubtful if they will be within the next several years. Also, the Executive Engineer of AMAFCA has indicated that he may develop a different plan for handling this drainage.

In order to be able to develop the property now, it will be necessary to insure that the runoff to downstream areas is not increased and also to insure that

runoff is collected at places where future flood control projects can accept it without creating the need for extensive rebuilding. Therefore, it is apparent that in the phasing of improvements, it will be necessary to construct some channels and some ponding areas and to reserve these for drainage purposes until such time as permanent drainage facilities are provided by AMAFCA or the city. These requirements are indicated on Plate I.

5. THE MASTER PLAN: The Master Plan consists of defining a generalized land use plan and basic street system to break the total acreage up into relatively large tracts in order to make land available for purchase or lease. This plan is shown on Plate 2.

In developing the proposed land use plan, we have inventoried all undeveloped land in tracts larger than 40 acres within one mile of Interstate Highway interchanges and tabulated zoning or potential zoning. This inventory and the analysis pertinent to it and our judgment has led us to the conclusion that the bulk of the ATRISCO BUSINESS PARK east of 78th Street should be dedicated to industrial uses, together with a relatively small amount of commercial and high density residential

use which the industrial activity will attract. We believe the area west of 78th Street should be directed to travel and tourist oriented uses together with the development of a large top quality mobile home park with primary access to the mobile home park being from Central Avenue.

The Master Plan must provide maximum flexibility as to type of development. Construction of the basic street system will open up the area for potential uses. Actual development can then be geared to the market, this being the only practical way to approach the planning process.

6. DEVELOPMENT PLAN: Plate 3 shows a development plan. It has been prepared in order to give Westland and regulating agencies some insight as to how the area might develop and to provide a means of estimating development costs. It should be used as a generalized guide for the development program as it proceeds.

7. PHASING OF DEVELOPMENT: We propose that the entire area be submitted for annexation and SU-1 zoning for a planned business, commercial and indistrial center. We also propose that the rights-of-way shown on Plate 2 be dedicated at the time of annexation and the rights-of-way for 78th Street, the west side of Coors Road and the

flood control channel be reserved and dedicated in the future provided agreements pertaining to construction of these improvements satisfactory to Westland are reached.

After annexation, we propose that utilities, paving and drainage improvements shown on Plate 2 be placed in a special assessment district and constructed at the earliest possible date.

It will be noted that we propose to improve Airport Road and Fortuna Road in the initial phase. If these are protested out by other owners, we suggest they not be improved until such time as the city can resolve or overrule the protests.

The Phase I development shown on Plate 2 will open up the property and make it available for development. Subsequent phases can be constructed as the demand for use of the land dictates.

8. DEVELOPMENT COST ESTIMATES: Preliminary detailed cost estimates have been prepared for the improvements both those for immediate construction and for the ultimate overall development. These estimates are summarized as follows:

a) Initial Development:

(1) Paving Costs	$510,000.00	
(2) Water Costs	$105,000.00	
(3) Sanitary Sewer Costs	$ 64,000.00	
(4) Drainage Costs	$ 60,000.00	
Total Estimated Phase I Costs		$739,000.00

If all these improvements are placed in a special improvement district, it will be paid in twenty payments, one each six months for ten years. The first payment due approximately three months after completion of construction will be approximately $81,290.00 decreasing to approximately $39,536.00 for the final payment which will be due at the end of ten years.

The cost of the remaining development based on the development plan shown on Plate 3 is tabulated as follows:

(1) Paving	$925,000	
(2) Water	$199,000	
(3) Sanitary Sewer	$256,000	
(4) Drainage	$ 50,000	
Total		$1,430,000

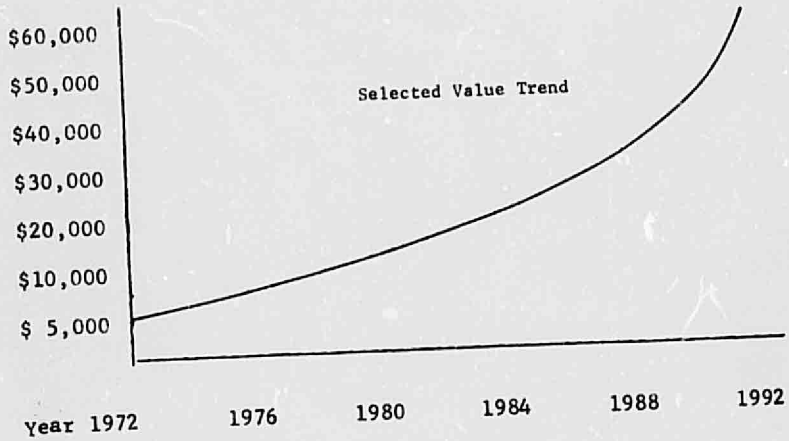
This produces a total Westland cost of development of $2,169,000. The estimated net area for development after all streets and other right-of-way and all parks

are dedicated for public use is 546 acres. Therefore, the estimated development cost is $3,972.00 per net developable acre. These improvements will add at least double the cost to the base value of the land.

9. LAND VALUE: The value of land is that amount which a purchaser is willing to pay for it. Our investigation has disclosed that there exists a mild demand for raw land in this area at about $4,000 per acre. We emphasize that all of it could not be sold for this amount at this time but that over a period of time it could be marketed at this price. Upon approval of this report the start of construction of the Amerace plant and annexation to the city, the land will immediately increase in value. We believe this increase will be on the order of $1,000 per acre. As utilities and paving are constructed, the value will be increased by an amount somewhat greater than the cost of those improvements. For the purposes of this report, we must assume that only 546 developable acres are available, the balance being given up in dedication of public rights-of-way. Sixty acres of this are already gone to Amerace and the other industrial plant. This leaves 486 acres available for sale, lease or development. We have used a

development period of twenty years for the purposes of this report. We emphasize that we believe the area will develop in less than twenty years but feel that prudence demands that we use the longer period for economic forecasting.

At the beginning of the study period, we start with 486 acres of land having a value of $5,000 per acre. As the utility and paving improvements are made and as actual property development occurs, values will increase. Prime industrial and commercial land in the Albuquerque area is currently selling for $30,000 to $40,000 per acre in relatively highly developed areas. As the ATRISCO BUSINESS PARK develops, it will approach these values. Basic land values can be expected to increase due to inflationary pressures. We believe that land value will increase at least fifty percent in the next twenty years. Therefore, for the purposes of this report, we have placed a value on the land remaining at the end of twenty years of $60,000 per acre. The foregoing analysis is presented graphically as follows:



This curve represents our best judgment as to the forecasted value of the land if development is pursued as now planned.

10. DEVELOPMENT COST AND INCOME FORECAST: As has previously been stated, the Westland Board desires to eventually get to a position to lease the land rather than sell it, we believe this is sound thinking since the increase in value will be essentially permanent. Also properly designed leases can provide a hedge against inflation.

However, for the purposes of this analysis, we have assumed all land will be sold since only in this way can we present a logical picture of the yield which can be

anticipated. We emphasize that this in no way precludes leasing and in fact we recommend leasing wherever possible. The net effect of leasing should be essentially the same since the proceeds of land sales can be invested and should produce about the same income.

We have assumed that after the initial development described as Phase I, the balance of the development costs will be performed uniformly over a ten year period and financed with special assessment districts with a ten year repayment schedule. It should be noted that the costs of future paving and utility improvements have been escalated at the rate of three percent per year. These costs can be expected to go up and the expense forecast can be accurate only if the cost increases are anticipated.

This produces an expense and income forecast tabulated as follows:

11. CONCLUSIONS AND RECOMMENDATIONS: From the foregoing analysis, we conclude that development of the ATRISCO BUSINESS PARK is not only feasible but that it represents an undertaking which will produce a large amount of income to Westland for the benefit of the heirs of Atrisco.

Our recommendations are summarized as follows:

(1) Proceed with annexation, zoning and dedication of public rights-of-way. In this activity, it should be understood that the requirements of the various approving agencies must be met.

(2) Immediately upon completion of annexation, place the improvements described as Phase I in a Special Assessment District and secure those improvements.

(3) Design and pursue a vigorous sales program in developing the rest of the property. In this connection, you may employ an aggressive real estate firm or develop your own sales organization. In either event, you should work closely with AIDS and IFA in seeking a developer.

(4) Add improvements (additional utilities and paving) as sales dictate, placing these improvements in special assessment districts.

(5) Have the Westland office building designed and built on your property.

(6) Examine the feasibility of building and operating the mobile home park as a Westland enterprise. If you decide to go this way, hire a manager for this enterprise to be involved right from the start of design.

(7) Whenever a bona fide demand for a building to be leased to a tenant develops and satisfactory leasing arrangements can be made, build the building.

(8) Examine the feasibility of building at least one apartment building at an early date. The mobile home park manager can also manage this building. Construction of one building may attract other apartment developers to the area or the demand may be such that Westland will wish to expand this operation. In this connection, we recommend that initial development be moderate priced apartments. We see no demand for luxury apartments at this time.

(9) Finally, we recommend that you work diligently at improving the Westland image in the community. You should be known as an aggressive but public spirited business organization, which in fact you are, but you should work at letting the community know that this is the case. Your employees and officials should become active participants in all types of community public

service activity, the Chamber of Commerce, AIDS, IFA, United Fund, civic clubs, etc. Be a part of the community and the rewards, both corporate and personal, will be forthcoming.